

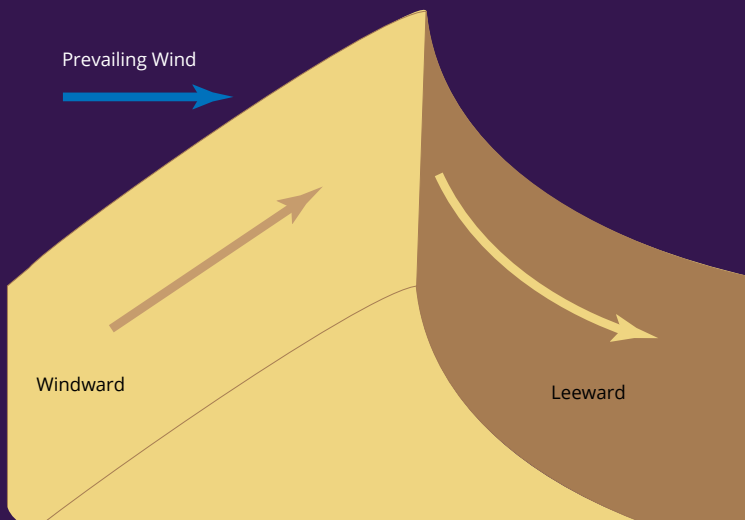
Shifting Shapes of Sandy Scapes

Building sand castles is a summer pastime, whether in a sandbox or at the beach. Nature builds with sand, too, using wind to create different shapes.

Satellites give scientists a birds-eye view of dunes around the world. These images and data help scientists figure out how dunes formed and how winds, waves, and humans can change them over time.



Namib Sand Sea, Namibia



What is a Sand Dune?

Dunes form when wind blows bits of sand into piles, creating mounds or ridges that slowly move. Sand blows up the **windward** side of a dune and slides down the **leeward** side. Like a game of leapfrog, a dune slowly moves as grains of sand move up the windward face and down the leeward slope — called a **slip-face** because it is where the sand slips down.

Vocabulary



windward – The side of a dune, mountain, or hill facing the wind.

leeward – The side of a dune, mountain, or hill facing away from the wind.

slip-face – The steep leeward side of a dune where sand falls as wind moves it over the peak.

One way that dunes move is saltation: sand particles skip along the ground like a rock thrown across a pond. When these particles land, they bump into other particles and cause them to skip, too.

Why Study Dunes?

Dunes move over time, which can be a problem for desert or coastal communities. Sand can cover parks, parking lots, or buildings. And moving or shrinking dunes near a beach can indicate that the sea is reshaping the coast.

Tracking dunes from space helps town planners make decisions about where and how to build. In some places, trees or grasses are planted to slow the movement of dunes. In other areas, engineers can develop fences or other methods to **stabilize** the sands. In China and Africa, trees have been planted in hopes that they will hold back advancing deserts.

Sand dunes, like this one in Namibia, move in a few different ways — all helped by wind.



Types of Sand Dunes

Over long periods of time, prevailing winds usually determine the shapes of dunes. A prevailing wind is the direction from which the wind blows most of the time. For example, in North America, the prevailing winds blow from west to east. That's why storms usually come from the west.



Namib Sand Sea,
Namibia

Linear Dunes

If you were to take your fingers and run them through sand, you would create ridges that all run in the same direction. That is what linear dunes look like when seen from space. These dunes line up in the same direction that the wind blows. (In geometry, this is called parallel.)

Strong winds from the south help build long linear dunes in the Namib Sand Sea. The Namib desert is believed to be more than 30 million years old.



Vocabulary

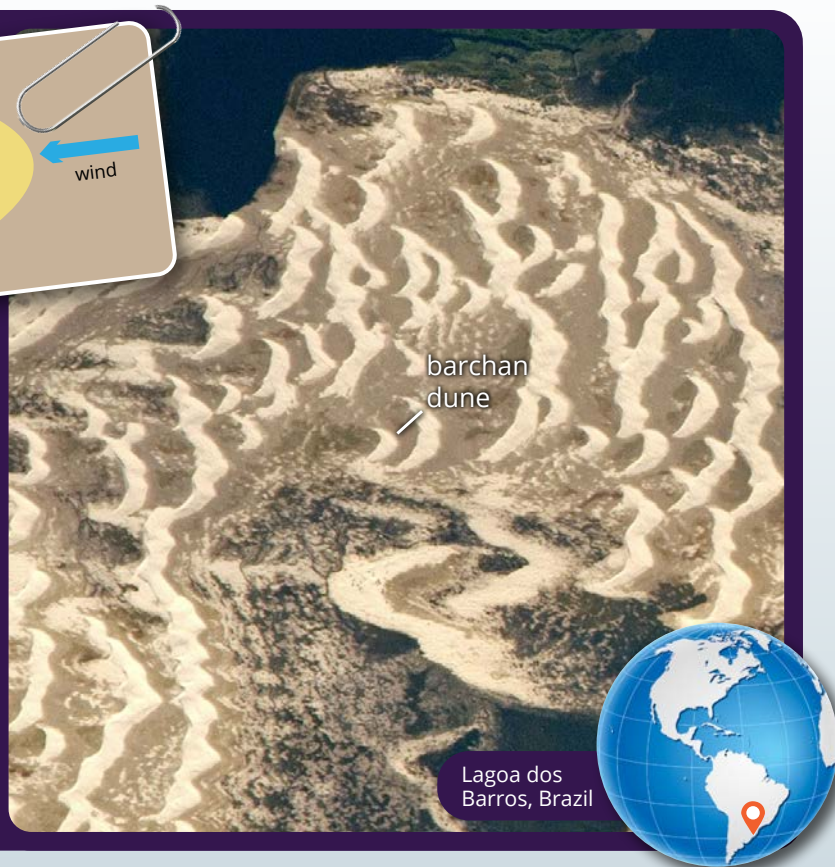
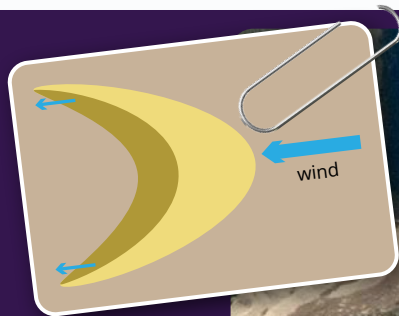


stabilize – To stop something from moving or changing.

Barchan Dunes

Barchan dunes have crescent-shaped ridges and the tips point downwind. The windward side of the dune is gently sloped and bright where the Sun reflects off of it. The leeward side is steep and dark because it lies in the shadow of the dune. This steep slip-face can make a fun slope for sandboarding or sledding.

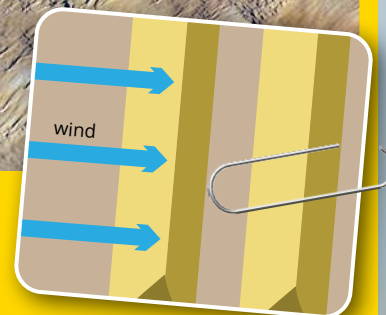
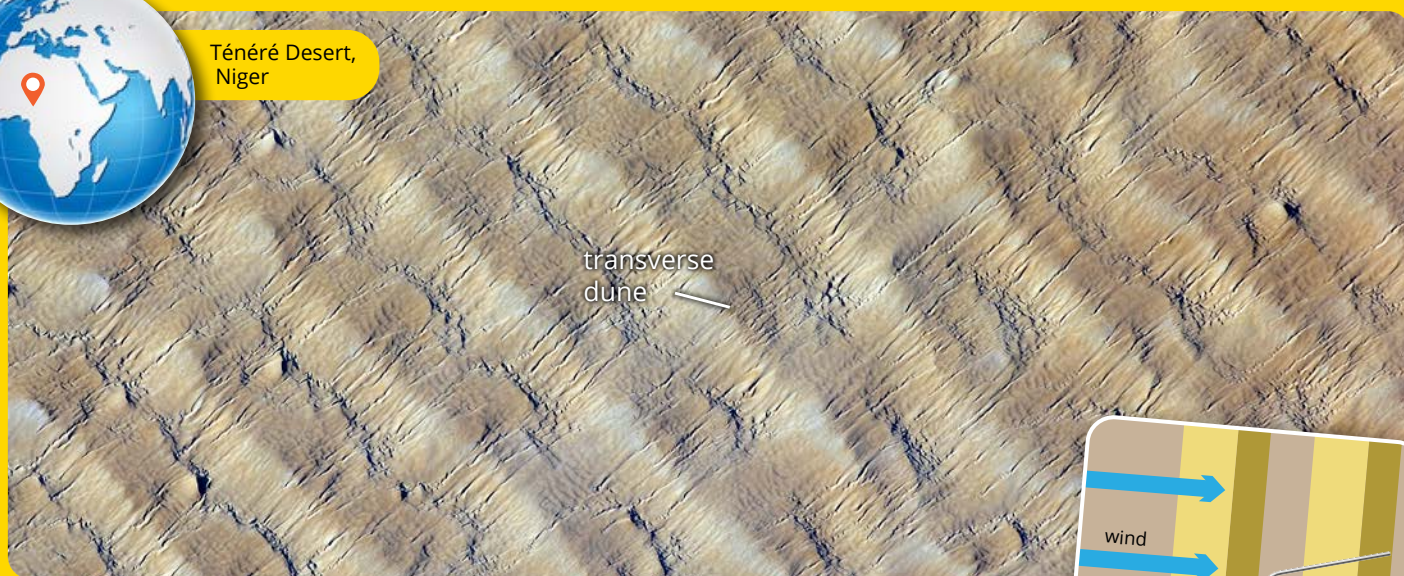
This photograph from the International Space Station shows C-shaped barchan dunes along the coast of southern Brazil. Their tips point to the west, downwind of the prevailing easterly wind. These dunes act as barriers, preventing the wind and waves from eroding the ground inland.



Lagoa dos Barros, Brazil



Ténéré Desert, Niger



Transverse Dunes

Transverse dunes look a lot like linear dunes, but the wind forms them a little differently. The wind pushes the sand like a bulldozer into long, gently sloping heaps. At the peak, sand slides down the slip-face like an avalanche, creating a steeper leeward side of the dune.

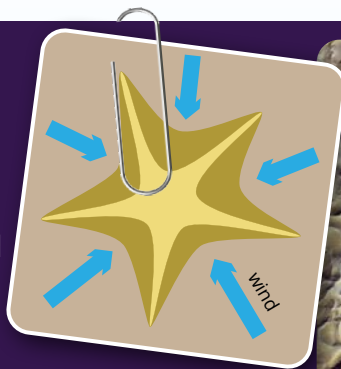
An astronaut took this photo of long, large transverse dunes cutting across the Ténéré Desert of Niger. These transverse dunes are a special type called zibars. These dunes have hard, rough surfaces that form because the wind blows away the finer sand and leaves behind coarser, heavier grains on the surface.

Star Dunes

Star dunes have sweeping ridges that converge at a single point and can reach 150 to 250 meters (500 to 800 feet) tall.

They are shaped by winds blowing in many different directions at different times. Think about it like this: If you are building a tall sand castle without a bucket, you might use your hands to push sand into a mound around one central point. The changing winds are like your hands pushing the sand into a pile from every direction.

The winds in the Grand Erg Oriental tend to be complex and changeable. Easterly summer breezes shift westerly in the winter, and passing storms can bring winds from multiple directions.



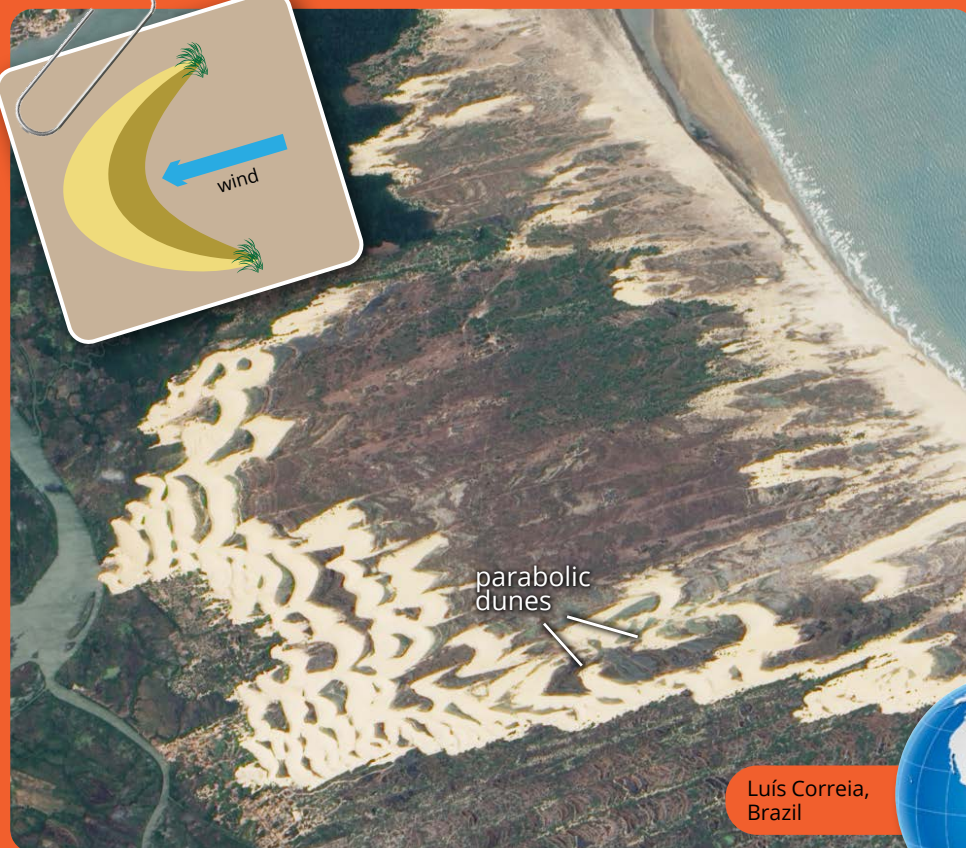
Grand Erg Oriental, Algeria



Parabolic Dunes

Parabolic dunes typically form near the ocean on sandy beaches with some vegetation. Beach grasses and plants anchor the tips of the dunes, and the wind blows out the center. This forms crescent-shaped dunes with tips facing into the wind. (The tips of barchan dunes point in the same direction as the wind.)

In northeastern Brazil, windblown parabolic dunes are marching away from the Atlantic Ocean toward inland lakes. They migrate about 17.5 meters (57.5 feet) each dry season.



Luís Correia, Brazil



DIY Science

Sandbox Dunes

Wind direction plays an important role in how dunes form. How many different types of dunes can you and your friends make?

Instructions:

1. Put on safety goggles.
2. Fill a container with a thin layer of sand and smooth the sand.
3. Use a blowdryer to blow steadily and gently across the container of sand. What type of dune did you make?



Materials

- Sand
- Container
- Blow-dryer
- Grass
- Safety goggles

Extension:

1. Can you make dunes with wet sand?
2. How does grain size effect dune formation?



4. Smooth the sand.
5. Plant two small patches of grass in the sand.
6. Use a blowdryer to blow steadily and gently across the container of sand. What type of dune did you make?
7. Using what you learned about dunes, experiment by varying the direction of the wind.

Martian Dunes

NASA scientists study dunes on Mars, too. The Bagnold Dunes on Mars have crescent-shaped barchan dunes around the outside and linear dunes in the center. By studying dunes on Earth, scientists are better able to understand how dunes form on other planets.



Answers
3. barchan dune
6. parabolic dune